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Extended Summaries 42nd Hungarian Plant Protection Days Meeting

The following are extended summaries based on papers presented at the 42nd Hungarian Plant Protection Days Meeting, organised by the Hungarian Agricultural Society, the Hungarian Academy of Sciences, the Hungarian Ministry of Agriculture and the Plant and Soil Protection and Soil Conservation Station of Budapest and held in Budapest, Hungary on 27/28 February, 1996. They are entirely the responsibility of the authors and do not necessarily reflect the views of the Editorial Board of Pesticide Science.

Control of Leaf Rust of Winter Wheat, *Triticum aestivum*, in Hungary

István Füzi

Plant Health and Soil Conservation Station of Tolna County, POB 104, H-7101 Szekszárd, Hungary

The most serious pest of winter wheat in Hungary in 1994 and 1995 was leaf rust (*Puccinia recondita* Rob. ex Desm.). In fields growing varieties of wheat sensitive to leaf rust (e.g. MV 15, MV 21) a crop damage of 30–40 (50)% was commonplace.

The leaf rust epidemic of 1994 was unexpected since there had not been any serious infection for many years. That year our fungicide trials were directed against powdery mildew (*Erysiphe graminis* DC f. sp. *tritici* Marchal) since that disease seemed to be prevalent at the beginning of the trial (in April); however, this disease receded, and leaf rust became significant.

The first uredospore colonies of leaf rust were found on 21 April and six weeks later leaves in untreated control plots were completely infected and dried up. In those circumstances the only treatment that provided a perfect protection until the end of the growth season was epoxiconazole + tridemorph sprayed at heading. Materials in the tests reported here are in Table 1 and results for trials in 1994 are in Table 2.

In spring of 1995 there were many signs of another possible leaf rust epidemic so our trials were aimed at that disease. A large number of fungicides and fungicide mixtures were investigated for their preventive effects, the duration of protection, and for their curative effect.

The preventive spraying was done at heading (Zadocks Growth Stage (GS)52) on 18 May, when an average of 1·3% of the upper surface of the top three leaves was infected. Twenty-five days after spraying the fungicides could be grouped into four main categories according to their performance. Those containing epoxiconazole, tebuconazole or cyproconazole active ingredient were totally effective (100% control); triadimenol, flutriafol + carbendazim and propiconazole + fenpropimorph were excellent (97–99%) and bromuconazole, flusilazole + carbendazim, propiconazole and triadimefon performed well (*c.*85% efficacy). Triforine had similar efficacy but this persisted for a shorter period. Chlorothalonil, prochloraz and metiram seemed to have poor activity. The results for these trials are in Table 3.

The formulations containing epoxiconazole or tebuconazole gave protection for the longest periods; they showed outstanding efficacy even 5 weeks after the spraying. Cyproconazole + carbendazim was effective for four weeks and the other sterol biosynthesis inhibitors for three and a half weeks (but triforine for only two or three weeks). At the second assessment (on 19 June) the only effective treatments were those that had shown total (or almost total) control at the first assessment.

The curative spraying was done at milky ripeness (Zadocks GS72) on 6 June when the average leaf rust infection had already exceeded 30% on the upper three leaves, and with 4–5% infection on the flag leaf. The order of efficacy was similar to that with preventive spraying (except for bromuconazole, which was found to have a rather poor curative activity). The fungicides containing epoxiconazole, tebuconazole or cyproconazole active ingredients prevented development of the rust on the upper leaves, small dry spots remaining in the place of uredospore colonies (Table 4).

Other pathogens (*Fusarium* spp., *Helminthosporium tritici-repentis* Died and *Septoria tritici* Rob. ex Desm.) also influenced the yield but leaf rust was the most significant of all as is shown by that fact the efficacy of the treatments against leaf rust is in harmony with their positive effect on the yield.

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TABLE 1
Formulations Investigated for Control of Leaf Rust on Winter Wheat

Active ingredient	*Product name*	*Formulation type*	*Type of activity*[a]
Bromuconazole	Granit	SC	DMI
Carbendazim	Kolfugó 25	SC	Systemic[b]
	and Kolfugó Super	SC	Systemic[b]
Chlorothalonil	Bravo 500	SC	Contact
Cyproconazole + carbendazim	Alto Combi 240	SC	DMI/systemic[b]
Epoxiconazole + tridemporph	Tango	SE	DMI/morpholine[c]
Flusilazole + carbendazim	Alert	SC	DMI/systemic[b]
Flutriafol	Impact	SC	DMI
Flutriafol + carbendazim	Milstar	SC	DMI/systemic
Metiram	Polyram	WG	Contact
Prochloraz	Sportak 45	EC	DMI
Propiconazole	Tilt 250	EC	DMI
	and Tilt Premium	WP	DMI
Propiconazole + fenpropimorph	Archer	EC	DMI/morpholine[c]
Sulfur	Szulfur 900	SC	Contact
	and Kumulus	WG	Contact
Tebuconazole	Folicur 250	EW	DMI[d]
Tebuconazole + triadimenol	Folicur Plus	EC	DMI[d]/DMI
Triadimefon	Bayleton 25	WP	DMI
Triadimenol	Bayfidan 250	EC	DMI
Tridemorph	Calixin	EC	Morpholine[c]
Triforine	Saprol	EC	DMI

[a] DMI = 14 α-demethylation-inhibitor in sterol biosynthesis/systemic.
[b] Inhibits development of germ tubes, the formation of appressoria and the growth of mycelia.
[c] Blocks the reduction of the C14–C15 double bond and suppresses Δ8–Δ7 isomerase in sterol biosynthesis/systemic.
[d] Suppresses of Δ8–Δ7 isomerase also.

The only treatments that improved the quality of the crop were those that could protect the plant effectively from heading to full ripeness (Zadocks GS90). The curative treatments that were effective did not improve the quality of crop and sometimes made it worse.

These trials indicate that leaf rust epidemics can be prevented by a single spray application (as is common in Hungary) provided that the most effective fungicides (containing epoxiconazole, tebuconazole or cyproconazole active ingredients) are used and the spray is applied before the rust infection exceeds 5–10% on the upper three leaves. The optimal time for spraying in 1994 and 1995 was at heading.

Leaf rust can be cured effectively and yield can be maintained even when curative sprays are applied at a high rate of infection, but the quality of crop will be lower in those cases.

TABLE 2
Performance against Leaf Rust in Winter Wheat (var. MV15) of a Number of Treatments in a Trial at Szekszárd, Hungary in 1994[a]

Active ingredient(s)	*Dose (g AI ha^{-1})*	*Applied 1994*	*Leaf surface infection (%)*			*Average yield (tonnes ha^{-1})[b]*
			13 May (Zadocks GS54)	*3 June (Zadocks GS73)*	*20 June (Zadocks GS84)*	
Untreated control	—	—	3·1	99·7	100·0	3·87 (0)
Surfur[c]	3·20	21 April	2·0	97·4	100·0	4·26 (10)
Tridemorph	0·38	21 April	1·9	95·1	100·0	4·40 (14)
Propiconazole[d]	0·13	21 April	0·2	65·4	100·0	4·48 (16)
Tridemorph	0·38	13 May	3·1	89·5	100·0	4·80 (24)
Sulfur[c] +	3·20					
Metiram	1·60	13 May	3·1	81·3	100·0	4·74 (22)
Propiconazole[d]	0·13	13 May	3·1	15·7	98·5	5·20 (34)
Carbendazim[e]	0·40	21 April +				
		13 May	0·7	20·4	100·0	5·04 (30)
Tridemorph	0·38	21 April				
Propiconazole[d]	0·13	13 May	1·9	5·1	97·9	5·53 (43)
Sulfur[f]	4·50	27 April				
Flutriafol +	0·13					
Carbendazim[g] +	0·25					
Tridemorph	0·26	19 May	2·0	1·8	35·0	6·40 (65)
Epixiconazole +	0·13					
tridemorph	0·38	13 May	3·1	0·1	0·1	7·28 (88)

[a] Treatments were applied to one 0·1-ha plot using a Szantox sprayer fitted with a Tee-Jet 11008 nozzle. The volume of the spray was 250 litres ha^{-1}.
[b] Percentage increase over control in parentheses.
[c] As in Kumulus.
[d] As in Tilt 250.
[e] As in Kolfugo Super.
[f] As in Szulfur 900.
[g] As in Kolfugo 25.

TABLE 3
Performance against Leaf Rust in Winter Wheat (var. MV 15) of a Number of Preventive Treatments in a Trial at Szekszárd, Hungary in 1995[a]

Active ingredient(s)	*Dose* (*g AI ha*$^{-1}$)	*Leaf surface infection* (%) *7 June*[b] (*Zadocks GS72*)	*19 June*[c] (*Zadocks GS82*)	*Average yield* (*tonnes ha*$^{-1}$)
Untreated control	—	85·7	100·0	4·27 (0)
Metiram	1·60	59·8	100·0	4·31 (1)
Prochloraz	0·45	53·3	99·7	4·87 (14)
Chlorothalonil	1·00	51·6	95·9	5·00 (17)
Triforine	0·27	22·8	91·0	5·18 (21)
Triadimefon	0·13	13·0	88·4	5·29 (24)
Propiconazole[e]	0·12	12·1	79·7	5·42 (27)
Flusilazole + carbendazim	0·13 + 0·25	10·3	75·4	5·36 (26)
Bromuconazole	0·24	10·5	73·0	5·56 (30)
Propiconazole + fenpropimorph	0·13 + 0·30	2·5	72·6	5·58 (31)
Flutriafol + carbendazim	0·09 + 0·15	1·9	67·3	5·86 (37)
Triadimenol	0·13	1·2	56·7	6·07 (42)
Cyproconazole + carbendazim	0·06 + 0·15	0·0	8·3	6·45 (51)
Tebuconazole	0·25	0·1	2·6	6·10 (43)
Tebuconazole + triadimenol	0·19 + 0·09	0·1	1·1	6·33 (48)
Epoxiconazole + tridemorph	0·13 + 0·38	0·0	0·6	6·55 (53)
	SD 5% =	5·7	6·0	0·20 (5)

[a] Treatments were applied on 18 May (Zadocks GS52) to one 0·05-ha plot using a Szantox sprayer fitted with a Tee-Jet 11006 nozzle. The volume of the spray was 330 litres ha^{-1}.
[b] The average of the uper three leaves.
[c] The average of the upper two leaves.
[d] Percentage increase over control in parentheses.
[e] As in Tilt Premium.

TABLE 4
Performance against Leaf Rust in Winter Wheat (var. MV 15) of a Number of Curative Treatments in a Trial at Szekszárd, Hungary in 1995[a]

Active ingredient(s)	*Dose* (*g AI ha*$^{-1}$)	*Flag leaf surface infected on 19 June* (*Zadocks GS82*) (%)	*Average yield* (*tonnes ha*$^{-1}$)[b]
Untreated control	—	100·0	4·27 (0)
Bromuconazole	0·24	74·1	4·80 (12)
Flusilazole + carbendazim	0·13 + 0·25	39·3	5·26 (23)
Propiconazole[c]	0·12	33·2	5·59 (29)
Flutriafol + carbendazim	0·09 + 0·15	10·4	5·41 (27)
Cyproconazole + carbendazim	0·06 + 0·15	0·1	5·69 (33)
Tebuconazole + triadimenol	0·19 + 0·09	0·0	5·63 (32)
Epoxiconazole + tridemorph	0·09 + 0·26	0·0	5·68 (33)
	SD 5% =	14·3	0·20 (5)

[a] Treatments were applied on 6 June (Zadocks GS72) to one 0·05-ha plot using a Szantox sprayer fitted with a Tee-Jet 11006 nozzle. The volume of the spray was 330 litres ha^{-1}.
[b] Percentage increase over control in parentheses.
[c] As in Tilt Premium.